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EXAMINER	
STULTZ, JESSICA T	
ART UNIT	**PAPER NUMBER**
2873	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/523,122	SASAKI ET AL.	
	Examiner	Art Unit	
	Jessica T. Stultz	2873	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 October 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) *1-8,26 and 27* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *9-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 January 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *0105,0506,0806*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Group III, claims 9-25 in the reply filed on October 24, 2006 is acknowledged.

Claims 1-8 and 26-27 have been withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected group, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on October 24, 2006.

Claim Objections

Claim 9 is objected to because of the following informalities: claim 9, line 1, "includes electro-optic crystal" should be "includes an electro-optic crystal". Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 12 (and therefore claim 15) is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Specifically regarding claim 12, the phrase "which covers the whole" is not clear since it is not clear if the insulator covers "the whole device", "the whole ridge portion", or some other meaning entirely. Based on what is disclosed in the specification and drawings, for purpose of examination, the assumed meaning is "which covers the whole ridge portion".

Claim 15 is rejected since it inherits the indefiniteness of the claim from which it depends.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 9 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Kikuchi et al US 5,526,169, herein referred to as Kikuchi et al '169.

Regarding claim 9, Kikuchi et al '169 discloses an electro-optic modulation device that includes an electro-optic crystal having a birefringence index changed by a coupled electric field (Column 7, line 6-Column 9, line 25, wherein the electro-optic modulator comprises a crystal "14", which changes the polarization of a laser beam based on an applied electric field from signal "9" and thereby has a variable birefringence index, Figures 5-7), and one pair of electrodes disposed so as to have the electro-optic crystal interposed therebetween to couple the electric field to the electro-optic crystal (Column 7, line 6-Column 9, line 25, wherein the pair of electrodes comprise "16" and "18" or "17" and "15", which surround the crystal "14" as shown Figures 5-7), and that changes polarization of light incident between the one pair of electrodes according to a change of the birefringence index depending upon a strength of the electric field coupled via the one pair of electrodes (Column 7, line 6-Column 9, line 25, wherein the polarization of light incident upon face "b" changes based upon the electric field strength applied to the electrodes by signal source "9", Figures 5-7), the electro-optic modulation device

comprising: a base portion (Column 7, line 6-Column 9, line 25, wherein the base portion is the electro-optic crystal "14", Figures 5-7); and a ridge-shaped portion projected on at least one side face of the base portion and extended in a direction of the incident light, at least a part of the ridge portion comprising the electro-optic crystal (Column 7, line 6-Column 9, line 25, wherein the ridge-shaped portion is the elevated portions of the crystal "14", Figures 5-7), the ridge portion having a width equivalent to a predetermined value or less (Column 7, line 6-Column 9, line 25, wherein the ridge-shaped portion has a width defined by the length of face "c", Figures 5-7), wherein the one pair of electrodes are formed on one pair of side faces opposed in a width direction of the ridge portion (Column 7, line 6-Column 9, line 25, wherein the electrodes "16" and "18" or "17" and "15" are formed along opposing sides of the crystal "14" in a width direction as shown in Figures 5-7).

Regarding claim 11, Kikuchi et al '169 further discloses that the ridge portion is formed on an end on the one side face of the base portion when seen from the direction of the light incidence (Shown in Figures 5-6, wherein the ridge portions are at the end of the side face "b" upon which light is incident).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kikuchi et al '169 as applied to independent claim 9 above.

Regarding claim 25, Kikuchi et al '169 discloses an electro-optic device as shown above wherein the ridge portion comprises electro-optic crystal (Column 7, line 6-Column 9, line 25, wherein the ridge portion comprises electro-optic crystal "14", Figures 5-7), wherein the base portion is made of a en electro-optic crystal made of KTP (Column 7, line 6-Column 9, line 25), but does not specifically disclose that the base portion comprises photonic crystal having a periodic structure. However it is well known in art electro-optic crystals for periodic photonic crystals to be made of KTP for the purpose of forming electro-optic crystalline structures with non-linear properties. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the electro-optic device of Kikuchi et al '169 to further comprise the base portion comprising a photonic crystal having a periodic structure since it is well known in art electro-optic crystals for periodic photonic crystals to be made of KTP for the purpose of forming electro-optic crystalline structures with non-linear properties.

Claims 10 and 12-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kikuchi et al '169 as applied to independent claim 9 above, in view of Minakata et al US 4,866,406, herein referred to as Minakata et al '406.

Regarding claims 10 and 12-14, Kikuchi et al '169 discloses an electro-optic modulation device as shown above, but does not specifically disclose that the ridge portion is formed nearly in the center on the one side face of the base portion when seen from the direction of the light incidence, or that the ridge portion is covered on the top surface by an insulator, wherein the insulator covers side faces of the pair of electrodes forming faces continuous to the top surface. Minakata et al '406 teaches of an electro-optic modulation device comprising a ridge portion formed nearly in the center on the one side face of the base portion when seen from the direction

of the light incidence (Column 8, lines 28-68, wherein the modulator shown in Figure 1 comprises a base portion "1" and a ridge portion "2" comprising an electro-optic crystal formed nearly in the center of the base from the light incidence side) wherein the ridge portion is covered on the top surface by an insulator, wherein the insulator covers side faces of the pair of electrodes forming faces continuous to the top surface (Column 8, lines 28-68, wherein the ridge portion "2" and sides of the electrodes "4" are covered by an insulating silicon dioxide layer "3", Figure 1) for the purpose of providing an insulating layer having a smaller refractive index than the optical waveguide to laminate the device in order to reduce dielectric losses (Column 7, lines 57-65 and Column 8, lines 28-68). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the electro-optic modulation device of Kikuchi et al '169 to further comprise a ridge portion formed nearly in the center on the one side face of the base portion when seen from the direction of the light incidence, wherein the ridge portion is covered on the top surface by an insulator, and the insulator covers side faces of the pair of electrodes forming faces continuous to the top surface since Minakata et al '406 teaches of an electro-optic modulation device comprising a ridge portion formed nearly in the center on the one side face of the base portion when seen from the direction of the light incidence wherein the ridge portion is covered on the top surface by an insulator, wherein the insulator covers side faces of the pair of electrodes forming faces continuous to the top surface for the purpose of providing an insulating layer having a smaller refractive index than the optical waveguide to laminate the device in order to reduce dielectric losses.

Regarding claim 15, Kikuchi et al '169 and Minakata et al '406 disclose and teach of an electro-optic modulation device as shown above wherein the insulator comprises a laminate

insulator made of polyurethane (Column 7, lines 57-65), but do not specifically disclose that the insulator comprises wax. However, it is well known in art of optical insulating laminates for polyurethane and wax to be used as known equivalents for the purpose of providing flexible insulative materials. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the insulator of Kikuchi et al '169 and Minakata et al '406 to further comprise wax since it is well known in art of optical insulating laminates for polyurethane and wax to be used as known equivalents for the purpose of providing flexible insulative materials.

Regarding claims 16-20, Kikuchi et al '169 discloses an electro-optic modulation device as shown above, but does not specifically disclose that the device comprises a low refractive index medium having a refractive index which is lower than a refractive index of the electro-optic crystal, at least near a side face of the ridge potion located on the base side and included in one pair of side faces other than the one pair of side faces on which the pair of electrodes are formed, wherein an upper portion of the ridge portion comprises the electro-optic material and a lower portion of the ridge or base portion comprises the low refractive index material, wherein the low refractive index medium is electro-optic crystal of similar components to the electro-optical crystal, but which is lower in refractive index on the basis of a difference in composition ratio. Minakata et al '406 teaches of an electro-optic modulation device comprising a ridge portion as shown above and further teaches that the device comprises a low refractive index medium having a refractive index which is lower than a refractive index of the electro-optic crystal at least near a side face of the ridge potion located on the base side and included in one pair of side faces other than the one pair of side faces on which the pair of electrodes are formed

wherein an upper portion of the ridge portion comprises the electro-optic material and a lower portion of the ridge or base portion comprises the low refractive index material (Column 7, line 40-Column 8, line 68, wherein the substrate "1" comprises a material (LiNbO3) which has a lower refractive index than the material (Ti-diffused $LiNbO_3$) of optical waveguide crystal section "2", Figure 1), wherein the low refractive index medium is electro-optic crystal of similar components to the electro-optical crystal, but which is lower in refractive index on the basis of a difference in composition ratio (Column 7, line 40-Column 8, line 68, wherein the substrate "1" is made of similar crystal material to the waveguide section "2" yet has a lower refractive index than the optical waveguide crystal section "2", Figure 1) for the purpose of providing an optical waveguide with small dielectric losses (Column 7, lines 57-65 and Column 8, lines 28-68). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the electro-optic modulation device of Kikuchi et al '169 to further comprise a low refractive index medium having a refractive index which is lower than a refractive index of the electro-optic crystal, at least near a side face of the ridge potion located on the base side and included in one pair of side faces other than the one pair of side faces on which the pair of electrodes are formed, wherein an upper portion of the ridge portion comprises the electro-optic material and a lower portion of the ridge or base portion comprises the low refractive index material, wherein the low refractive index medium is electro-optic crystal of similar components to the electro-optical crystal, but which is lower in refractive index on the basis of a difference in composition ratio since Minakata et al '406 teaches of an electro-optic modulation device comprising a ridge portion as shown above and further teaches that the device comprises a low refractive index medium having a refractive index which is lower than a

refractive index of the electro-optic crystal at least near a side face of the ridge potion located on the base side and included in one pair of side faces other than the one pair of side faces on which the pair of electrodes are formed wherein an upper portion of the ridge portion comprises the electro-optic material and a lower portion of the ridge or base portion comprises the low refractive index material, wherein the low refractive index medium is electro-optic crystal of similar components to the electro-optical crystal, but which is lower in refractive index on the basis of a difference in composition ratio for the purpose of providing an optical waveguide with small dielectric losses.

Regarding claims 21-24, Kikuchi et al '169 discloses an electro-optic modulation device as shown above, but does not specifically disclose that the device comprises a low refractive index medium in an upper part of the base portion comprises a gas or that the device comprises an adhesive agent located as claimed. Minakata et al '406 teaches of an electro-optic modulation device comprising low refractive index medium in an upper part of the base portion comprising a gas (Column 9, line 44-Column 10, line 35, wherein the gap "7" comprising air is the low refractive index medium in the upper part of the base portion, Figure 6) wherein the device comprises an adhesive agent located as claimed (Column 9, line 44-Column 10, line 35, wherein an adhesive agent comprises a buffer layer that acts as a laminate on an upper part of the base portion as claimed, Figure 6) for the purpose of providing an optical waveguide comprising a buffer layer and an insulating layer with small dielectric losses (Column 7, lines 57-65 and Column 9, line 44-Column 10, line 35). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the electro-optic modulation device of Kikuchi et al '169 to further comprises a low refractive index medium in an upper part

of the base portion comprising a gas wherein the device comprises an adhesive agent located as claimed since Minakata et al '406 teaches of an electro-optic modulation device comprising low refractive index medium in an upper part of the base portion comprising a gas, wherein the device comprises an adhesive agent located as claimed for the purpose of providing an optical waveguide comprising a buffer layer an insulating layer with small dielectric losses.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kobayashi et al US 5,617,203, Johnson et al US 5,493,426, and Sharp et al US 5,552,912 are cited as having some similar structure to the claimed invention since they disclose electro-optic modulators comprising crystals with variable birefringence indices.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jessica T. Stultz whose telephone number is (571) 272-2339. The examiner can normally be reached on M-F 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Mack can be reached on 571-272-2333. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jessica T Stultz
Examiner
Art Unit 2873
January 4, 2007

JORDAN SCHWARTZ
PRIMARY EXAMINER